COOPERATIVE WORK PERTAINING TO FARM MACHINERY IN THE SOUTH

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In these days of stress and strain the all-important question is economy. As has been said, the question now is not how to grow two blades of grass where one grew before, but how to grow two blades of grass for what it cost to raise one before--in other words, how to cut production costs. In general the farmer cannot control the selling price of his commodity, but by careful selection and use of equipment and by proper attention to other factors he can in some measure control the cost of producing it.

Refinement of machinery for better performance or better adaptation to the work desired of it, development of new low-cost machinery that will do the job better than it was done before, and careful selection of equipment for the work to be done are all factors entering into the cost of agricultural products. The projects herein discussed have all been worked out with that thought in mind--to discover means of lowering the cost of production.

ACTIVE PROJECTS

The Bureau of Agricultural Engineering of the U. S. Department of Agriculture at the present time is cooperating in the South in nine active projects, including one that has recently been closed except for completion of the report, as outlined herewith:

1. Forage drying: Fundamental information is being obtained as to the equipment necessary and the factors involved in the drying of forage crops by artificial means. Although considerable work along this line has been done by various States in the humid region, no means have yet been devised which could be recommended as economical for use on the ordinary farm. To expedite solution of the problem, a cooperative drier project has been set up at the New Iberia Live-stock Farm near Jeanerette, Louisiana, by the Bureaus of Agricultural Engineering, Plant Industry, and Animal Industry. Here a commercial drier of the conveyor type has been in operation during the past year. It is planned to supplement this installation with a drum-type drier this year, and to secure further fundamental data by using the driers separately and in combination. Tests will be made of the effects of wilting and of bruising, upon the drying process and upon the feeding value of the product.

2. Direct harvesting and artificial drying of rice: In the fall of 1929 observations and tests were made on a farm in Texas and on one in Arkansas, where rice was harvested with a combine and dried with a commercial drier. The work was continued during the 1930 and 1931 harvest seasons, and included field observations and studies dealing with some of the mechanical and economic factors involved in artifi-cial drying. The work was conducted cooperatively with the Bureau of Agricultural Economics.

The tests seem to indicate that, if the combine is to be used to any great extent for harvesting rice in the South, changes will have to be made in design to facilitate the operation across levees.

The levees in turn would need to be low and broad. The rice stalk or stem is usually green at harvest time, and the mass of this material has a tendency to choke the machine, necessitating frequent stops. The ground is usually soft and muddy, and soil sometimes so clogs the wheels as to prevent them turning, which enormously increases the power required to drag the machine across the field.

The high moisture content of the rice at harvest time makes it necessary to dry the grain artificially, when it is harvested with the combine, in order that it may be stored safely and that high milling yields may be obtained. The rice kernel is rather easily ruptured by sudden changes in temperature and moisture content. Therefore much care must be taken in the drying to obtain a high milling yield. Tests made with both experimental and commercial driers indicate that the moisture content of the rice should not be reduced more than 2 or 3 per cent in any one drying operation, and that about 24 hours should elapse between drying operations. The tests showed also that 120° F. is probably the maximum temperature of drying air that can be used without considerable injury to the milling quality of the grain.

3. Cotton-growing equipment: The purpose of this project is to determine the fundamental requirements of crop production equipment for machine methods of growing cotton on the principal soil types in the Southeastern States. The project includes studies of the factors that limit the use of machines--such as topography--and the collection of information that will act as a guide in overcoming these deterrents as far as possible.

The use of skid rings on cultivator wheels to prevent side slipping on hill sides has been shown to be effective and practicable. A variable-depth planter has been designed that should tend to ensure a fair stand by placing at least part of the seed regularly at whatever depth may be suitable to weather and other conditions. Changes in the construction of certain machines have been devised to make them more flexible and better adapted to work on terraced land. In these studies the Bureau of Agricultural Engineering is cooperating with the Alabama Agricultural Experiment Station, the Delta Branch of the Mississippi Agricultural Experiment Station, and several of the farm machinery manufacturers. With the information that we hope to obtain, the most efficient combinations of equipment and methods can be determined for the larger part of the conditions ordinarily met. As indicated on the program, Mr. John W. Randolph, in charge of the Bureau activities of this project, is to give a paper on one very important phase of this work.

4. Pink bollworm control: The Bureaus of Entomology and Agricultural Engineering have been conducting plowing and irrigation experiments for the control of the pink bollworm of cotton in and near Presidio, Texas, for the past four years. Mr. D. A. Isler of the latter Bureau is in charge of the engineering phases of the work.

5. Spraying and dusting equipment: This project was carried on for a number of years and until recently at Tallulah, La., by Mr. Elmer Johnson, now deceased. It was conducted in cooperation with the Bureau of Entomology, and related to dusting experiments directed against the cotton boll weevil. It was resumed the past fall in Georgia,

in cooperation with the same bureau, to investigate equipment and methods effective for combatting fungus diseases in pecan orchards. These diseases, including scab, leaf blotch, and brown leaf spot, are spreading and becoming more virulent each year. Mr. E. M. Dieffenbach is in charge of the agricultural engineering studies, which will include critical tests of existing spraying and dusting equipment with a view to improving performance and, if possible, developing more effective nozzles and accessories.

6. Fertilizer placement: The purpose of this investigation is to secure fundamental information which will aid in designing more efficient fertilizer distributing machinery, and to establish safer and more effective methods of applying fertilizer to the crops under observation. Studies relating to fertilizer placement for cotton are in progress at twelve locations in eight States--North Carolina, South Carolina, Georgia, Mississippi, Arkansas, Louisiana, Texas, and Oklahoma--and for beans in Florida.

To obtain accurate application of the fertilizers, special machines have been constructed from specifications drawn up by the Bureau of Agricultural Engineering. To insure uniform conditions throughout the study, the same machine is used at several locations. Two machines of identical design and construction were operated last year. A third machine with certain features adaptable to practices in Texas is now under construction.

This investigation is conducted cooperatively by the agricultural experiment stations of the respective States, the National Fertilizer Association, the Joint Committee on Fertilizer Application, and the Bureau of Agricultural Engineering. The Bureau of Chemistry

and Soils is cooperating in the work in South Carolina. Mr. G. A. Cumings, agricultural engineer of the Bureau of Agricultural Engineering, is in charge of the engineering phases of the work and is to present a paper before the agronomy section of this gathering.

7. Cotton ginning: This you will hear discussed by Mr. Charles A. Bennett of the Bureau of Agricultural Engineering, in charge of the engineering studies at the Department's cotton ginning laboratory at Stoneville, Miss.

8. Development of farm lands: This project, under the immediate direction of Mr. Geo. R. Boyd of this Bureau, consists of studies of the economic benefits to be secured on farms through better physical development of the individual farms, a better planned agricultural program, and the use of modern equipment.

The single improvement that will bring the greatest benefits apparently is, at least in most cases, the consolidation of small fields, which will make easier the carrying out of a soil building program of crop rotation and the more economical use of farm machinery.

Surveys have been made of some 75 farms in Georgia, South Carolina, North Carolina, Virginia, and southeastern Minnesota. On one Georgia farm of about 250 acres there were 18 separate cotton fields of irregular shape ranging in size from 0.4 acre to 28.6 acres, and 16 odd-shaped cornfields ranging in size from 0.9 acre to 14.4 acres. Just try to visualize the difficulties in planning a crop rotation for 34 fields! Recommendations were made to consolidate the fields into five fields, three about 60 acres in size and the other two something like half as large. It does not need much imagination to see how much

more easily rotations could be planned and how much better the farm would be adapted to the use of machinery. This is typical of thousands of other farms throughout the land.

9. Utilization and cost of farm power: This project deals with the usefulness of different forms of power for farming under different sets of conditions. The field studies have been completed and the data are being compiled and analyzed. The investigation has been conducted cooperatively by the Bureaus of Agricultural Engineering and Agricultural Economics and the State agricultural experiment stations of Arkansas, Georgia, Louisiana, Mississippi, South Carolina, Texas, and Virginia.

FUTURE PROJECTS

There are many other investigations which should be undertaken in the South, but which the Bureau of Agricultural Engineering has not yet been able to include in its active program. The following are a few of them, listed without any attempt to rate their importance. The first three relate to Southern problems particularly; the others are more national in application.

1. Soybean harvesting: The ordinary combine, which harvests soybeans successfully in Illinois and Indiana, fails in the Mississippi Delta. This appears to be the limiting factor in soybean raising in this area. A few tests the past season showed that the regular combine could not handle the rank growth of beans in the South without clogging badly. It is proposed to attempt harvesting another season with a different type of combine.

2. Cane harvesting: The Bureau of Agricultural Engineering started some work of a preliminary nature the past year, but the

investigation was interrupted by the sudden death last July of Mr. Elmer Johnson, who had been assigned to the project. It is not known definitely when the work can be resumed.

3. Farm machinery over terraces: Mr. Ramser, in charge of the engineering investigations on the Department's soil erosion experiment farms, at the recent Chicago meeting of the Power and Machinery Section of the American Society of Agricultural Engineers stressed the need of altering machinery to adapt it for better performance over terraces. Farms are being terraced at the rate of about 3 million acres per year. This is making more forcibly evident the need for more flexible equipment to work properly across terraces. In connection with soil erosion control experiments a considerable amount of information has been obtained relative to the use of present types of farm machinery on terraced land. Investigations both more intensive and more extensive are necessary, however, if progress in the adoption of erosion control methods is not to interfere with a more general use of large tillage and harvesting equipment.

4. Plowing investigations: Many States have conducted experiments on various phases of plowing. For a number of years the Bureau of Agricultural Engineering, in its corn borer control investigations, has been conducting extensive tests on several phases of the problem. Professor Nichols at Alabama Polytechnic Institute has done and is doing outstanding work in soil dynamics. Because of the enormous annual requirement of some two billion horsepower-hours per year for plowing, a reduction of even one per cent would effect a huge saving in the cost of plowing the farm lands of the nation. Good plowing id recognized

as good farm practice. Plowing is also, when properly done, considerably effective in the control of weeds, insect pests, and certain fungus diseases. Would not a nation-wide correlation of plow investigations be opportune? Many experiment stations would welcome such correlation, and so would a majority of the plow manufacturers.

5. Machinery for side-hill use: This means altering the machine to prevent side slippage and to minimize wear and tear due to the abnormal side thrust imposed. Mr. Randolph has demonstrated that with flanges on cultivator wheels cotton on side-hill fields can be cultivated much more easily than without flanges.

6. Fuels and lubricants: Liquid fuels are of great interest to all users of internal combustion engines and lubricants to all users of machinery. Realizing the importance of these subjects, particularly to the farmer, the American Society of Agricultural Engineers appointed a committee to work out plans for helping to reduce the cost of operating farm power units and machinery. The chairman of this committee was selected from the Bureau of Agricultural Engineering. Through this committee the Society of Automotive Engineers, oil refiners, State experiment stations, tractor manufacturers, and our Bureau have cooperated in attacking this problem, and are making progress.

7. Artificial drying of crops: Experiments on drying of many products are under way by a large number of experiment stations and other agencies. It seems probable that correlation of these investigations will be advantageous sooner or later.

8. Application of fertilizers: This project in relation to cotton has been mentioned with the active projects. Apparently it will

soon attain a national aspect if the present rate of growth in interest is maintained. Some experiments in relation to canning crops have been started in New York State.

9. Pest control: The studies in spraying and dusting for control of the cotton boll weevil and the pink boll worm have been stated with the list of active projects. Studies of mechanical equipment for control of the European corn borer have been in progress for some years in the northeastern States. The entomologists are continually finding new insect pests, or greater losses caused by previously known insects, so that the importance of such investigations is increasing each year. In most cases effective control measures include some application of engineering equipment or practices.

The foregoing outline of active and possible future projects indicates the importance of mechanical equipment investigations to agriculture in the South. Time does not permit discussion of the results expected or accomplished. The Bureau of Agricultural Engineering is appreciative of the cordial cooperative relations with the State experiment stations and other agencies, and hopes for continuation and expansion of such cooperation as opportunities are found to initiate new investigations of mutual interest.